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Pandas

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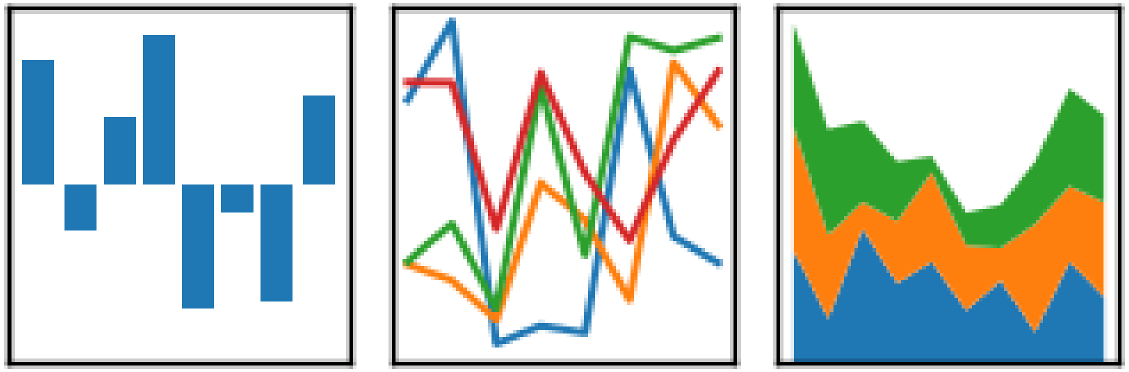
Learning Goals

- Understand main characteristics of Pandas
- Manipulate date with Pandas
- Use pandas in the context of data science problems

Pandas

- https://pandas.pydata.org/
- Open source library,
- BSD License
- High performance
- Easy to use
- Includes data structures and data analysis tools

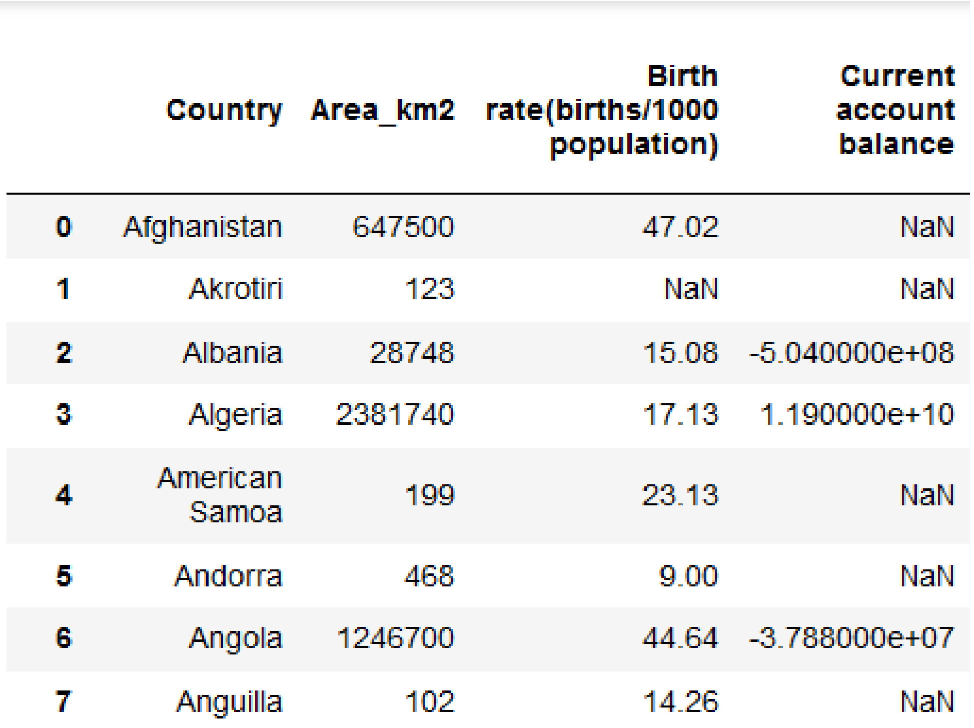


Data Structures

- Series
- DataFrame

DataFrame

- Labelled data structure
- Columns with potentially different data types
- Similar to spreadsheet or SQL table
- Most used object by Pandas



	Country	Area_km2	Birth rate(births/1000 population)	Current account balance
0	Afghanistan	647500	47.02	NaN
1	Akrotiri	123	NaN	NaN
2	Albania	28748	15.08	-5.040000e+08
3	Algeria	2381740	17.13	1.190000e+10
4	American Samoa	199	23.13	NaN
5	Andorra	468	9.00	NaN
6	Angola	1246700	44.64	-3.788000e+07
7	Anguilla	102	14.26	NaN

Create DataFrame

- Create dataframe from dictionary

```
import pandas as pd
d = {'col1': [1,2,1,3,1,2], 'col2':
[1,2,3,4,5,6]}
df = pd.DataFrame(data=d)
df.count()
df['col1'].value_counts()
df['col1'][1]=5
```

Copy DataFrames

- Copy column

```
col1=df['col1’]
col1[2]=99
```

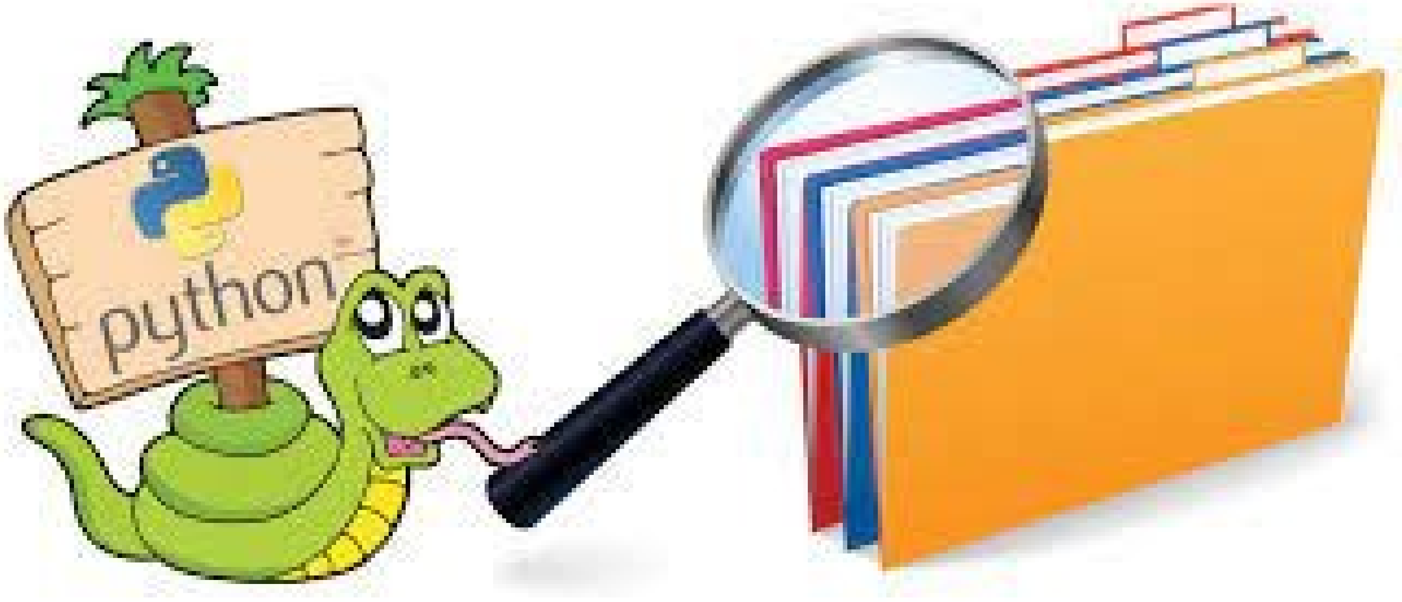
- What is the result in col1 and df?

```
new_col1 = col1.copy()
new_col[2]=9999
```

Read and Save

- Read and save into csv file:

```
import pandas as pd
df = pd.read_csv('worlddata.csv')
…
df.to_csv('worlddata1.csv')
```



Read and Save

- Read and save into csv file

```
url='https://shorturl.at/fi389'
df = pd.read_csv(url, error_bad_lines=False,index_col=0,sep=",")
```

Read and Save

- In collaboratoy:

```
from google.colab import files
files.upload()
```

- At the end

```
files.download(‘file name')
```

Dataframe Information

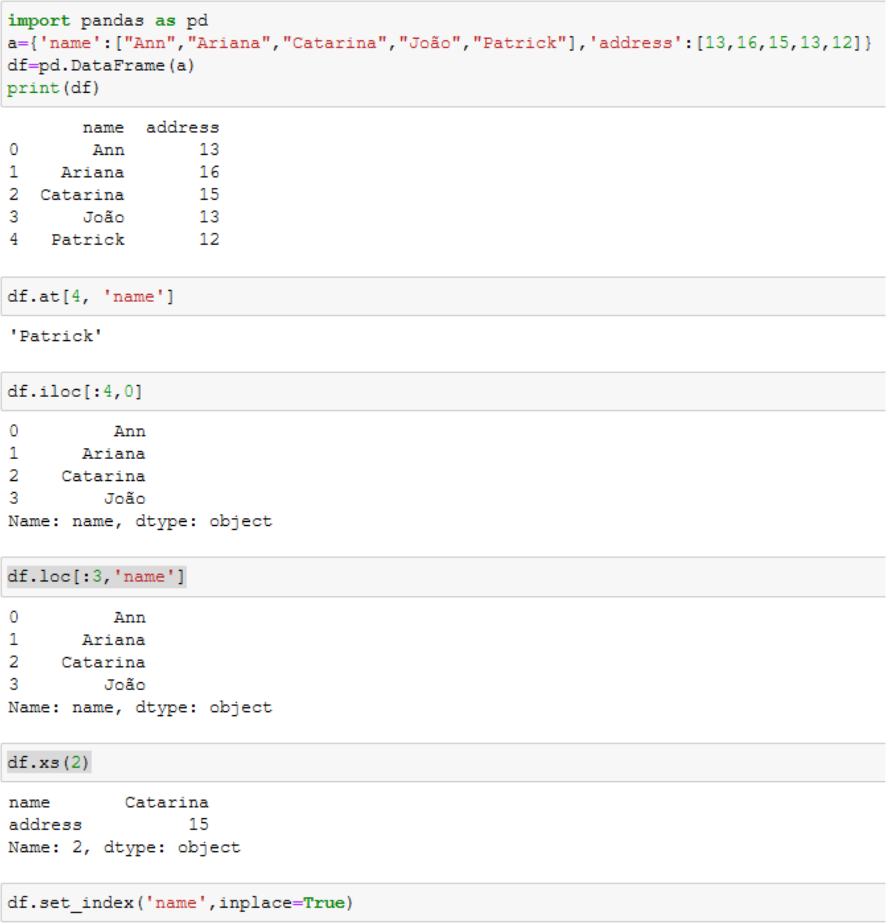
- Analyze information

```
df.head()
df.info()
df.describe()
df.columns
```

Access to Rows and Columns

- DataFrame.at - single value for a pair of row/column labels.
- DataFrame.iloc - integer-location based indexing for selection by position.
- DataFrame.xs returns cross-section from the Series/DataFrame.
- DataFrame.loc allow accessing a group of rows and columns by label(s) or a Boolean array.

Access to Rows and Columns



```
import pandas as pd
a={'name':["Ann","Ariana","Catarina","João","Patrick"],'address':[13,16,15,13,12]}
df=pd.DataFrame(a)
print(df)
```

```
       name  address
0       Ann       13
1    Ariana       16
2  Catarina       15
3      João       13
4   Patrick       12
```

```
df.at[4, 'name']
```

```
'Patrick'
```

```
df.iloc[:4,0]
```

```
0         Ann
1      Ariana
2    Catarina
3        João
Name: name, dtype: object
```

```
df.loc[:3,'name']
```

```
0         Ann
1      Ariana
2    Catarina
3        João
Name: name, dtype: object
```

```
df.xs(2)
```

```
name       Catarina
address          15
Name: 2, dtype: object
```

```
df.set_index('name',inplace=True)
```

Access to Row and Columns

- Cells:

```
df.iloc[195][0]
```

- Rows:

```
df.iloc[[195][0]]
```

- Columns:

```
df.loc[:,'GDPpercapita']
```

Copy

- Assignment

```
df1=df2
```

- Shallow copy

```
copydf = df.copy(deep=False)
```

- Deep copy

```
copydf = df.copy(deep=True)
```

Convert Data to Numeric

- Data types

```
df.dtypes
```

- If the result is object, we need to convert a complete column with specific label to numeric

```
df['GDP']=pd.to_numeric(df['GDP'], errors='coerce’)
```

```
pd.to_numeric(args, errors)
```

Convert Data to Numeric

- Suppose you have “,” instead of “.”
- Or you have $ or € symbols

```
df[‘GDP’]=df[‘GDP'].str.replace(',', ‘.’)
```

```
df[‘GDP’]= df[‘GDP'].replace('[\$,]', '', regex=True)
```

Create New Columns

- To create a column corresponding to the “internet per capita” it is necessary to do simply:

```
df[‘IntPC']=df['Internet users']/df['Pop’]
```

Removing Missing Values

- Create a new dataframe

YX = df[['GDP', ‘MilGDP','Unemploy rate(%)’]]

- And

YX.dtypes

- All numerical of course

Removing Missing Values

- Delete missing values from the entire array

```
YX=YX.dropna()
```

- Create X and Y:

```
Y = YX[['GDP’]]
X = YX[['MilGDP','Unemploy rate(%)
```

Remove missing values

- Delete missing values from the entire array

```
YX=YX.dropna()
```

- Create X and Y:

```
Y = YX[['GDPpercapita’]]
X = YX[['MilitPercentGDP','Unemploy rate(%)']]
```

Statistic Methods

- Using the previous dataframe, the following met

- X.mean()
- X.median()
- X.max()
- X.min()
- X.cov()
- X.corr()

- X.kurt()
- X.kurtosis()
- X.skew()

Conclusion

- Data structures: dataframe, series
- How to manipulate date
- How to clean and access to data

Additional Bibliography

- https://pandas.pydata.org/
- https://pandas.pydata.org/pandas-docs/stable/getting_started/10min.html
- https://scikit-learn.org/
- https://scikit-learn.org/stable/index.html
- https://www.statsmodels.org/stable/index.html